Vol. 13 December 1937 No. 12

Bulletin of the Agricultural Chemical Society of Japan.

TRANSACTIONS

The Nutritive Value of Fish Meals and Fish Cakes.

By Tetuo TOMIYAMA and Minoru HANADA.

(The Imperial Fisheries Institute, Tokyo; Received Oct. 21, 1937.)

Fish meal and fish cake are important marine products which are rich in protein, yet they have been widely used until recent time as fertilizer. Since the Norwegian Government proved in 1892 that fish meal was effective for feeding farm animals, considerable interest has centered in Germany in the use of it as a stock-feed. Fish meal feeding was soon adopted on the European Continent, and England became a great export market for fish meal. Since 1916, in both England and United States, the use of fish meal has increased gradually with a shortage of feedstuffs. In Japan, it was about twenty years ago that the production of fish manures was valued at about 40,000 Yen a year. But since that time the demand for it has decreased year by year as it has been possible to produce the artificial fertilizer by a cheap cost. Until 1925, the importation of fish meal totaled 2,000,000 Yen a year, but now Japan is doing one of its greatest items of export trade in fish meal for the Western countries.

Much research[1] has been done on the nutritive value of fish meal and fish cakes, and it has become clear that the nutritive value mostly depends on the methods of manufacture[2], as well as kinds and quality of the materials.[3] Among the various kinds of meals and cakes, those of sardine and herring are the most important product in our country, consequently attempts were made to compare the feeding quality of these meals and cakes on a protein basis as well as on a weight basis. The latter series of experiments were conducted because of the fact that fish products are sold by weight. These experiment showed that the meal and cake of sardine are superior in quality to those of herring, and that there is a very little difference between the meals and the cakes.

EXPERIMENTAL

The following meals and cakes were selected for the study; sardine-meal

and -cake, and herring-meal and -cake. All these materials were manufactured by the Nippon Shokuryo Kogyo Co. The composition of the samples is shown in Table I.

Table I.

Composition / Sample	Moisture	Total nitrogen	Crude protein	Crude fat	Total phosphorus
Sardine cake	11.90	9.44	59.00	6.90	4.72
Sardine meal	12.65	9.16	57.25	6.64	5.38
Herring cake	9.69	8.95	55.94	17.21	3.78
Herring meal	10.02	9.09	56.81	18.15	3.62

It will be noticed that between the sardine products and the herring products a considerable difference is observed in the fat content. The feeding experiments were carried out on a protein basis, giving diets identical in all respects with the exception of the protein content, i. e. 7 per cent and 10 per cent protein. Besides this series of experiments, comparisons on an equal weight basis were made, giving diets which contained 15 per cent samples. Rations planned to show the comparisons between the various samples were fed to young albino rats.

Experiment 1. The diet containing 7 per cent protein.

The amount of each sample, which contained 7 g moisture free protein, was 11.87 g for the sardine cake, 12.23 g for the sardine meal, 12.52 g for the herring cake and 12.32 g for the herring meal, respectively. The composition of the diet was as follows. The amount of starch was varied depending on the amount of fish meal incorporated in the diet.

Protein	the weight of the samples which contains 7 g protein.
Starch	75 g — (the weight of the samples which contains 7 g protein)
Cane sugar	5 g
Agar-agar	1 g
Butter	15 g
Salt mixture	4 g (McCollum Davis No. 185)
Oryzanin	4 cc

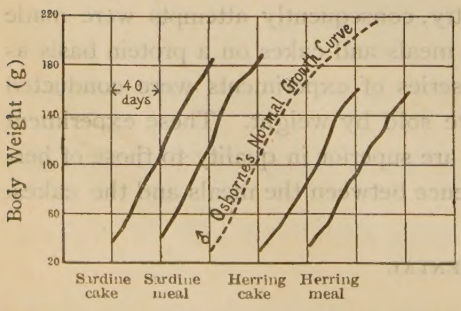

Fig. 1. Growth Curves at a 7% Protein Level.

The results obtained by feeding the males for three months were shown in Figure 1 and summarized in Table II. All the growth curves are the averages for three albino rats.

From the growth curves in Figure 1, it will be noted that the growth rate is nearly the same as the Osborne's normal growth rate, and that the rats fed the meals or the

Table II.

Sample / Body weight (g)	Sardine cake	Sardine meal	Herring cake	Herring meal
At the end of the experiment	187	190	164	160
At the begining of the experiment	36	40	31	30
The increase in the body weight	151	150	133	130
Average daily increase	1.76	1.74	1.15	1.51

cakes of sardine showed growth superior to any of the animals which received the meals or the cakes of herring.

Experiment 2. The diet containing 10 per cent protein.

The diet is the same as that in Exp. 1 in all respects except the protein content and the composition of the salt mixture. The composition of the salt mixture was modified in a following way; the calcium and phosphorus content of the salt mixture were reduced by the amount which is calculated from the phosphorus content of the meals or the cakes, assuming that the phosphorus in the samples may present as tricalcium phosphate. Fig. 2 and Table III give the growth curves for the females showing that the meal and cake of sardine are superior to those of herring. The growth rate in any case obtained by the diet was far better than the Osborne's normal growth rate.

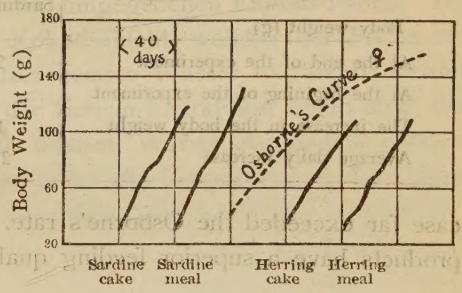

Fig. 2. Growth Curves at a 10% Protein Level.

Table III.

Sample / Body weight (g)	Sardine cake	Sardine meal	Herring cake	Herring meal
At the end of the experiment	119	132	107	110
At the begining of the experiment	30	30	34	31
The increase in the body weight	89	102	73	79
Average daily increase	1.75	2.00	1.43	1.55

Experiment 3. The diet containing 15 per cent samples.

By incorporating the samples into the diet at a 15 per cent level, comparisons were made on an equal weight basis. The protein level supplied by 15 per cent samples was 8.9 for the sardine cake, 8.6 for the sardine meal, 8.4 for the herring cake and 8.5 for the herring meal, respectively. The

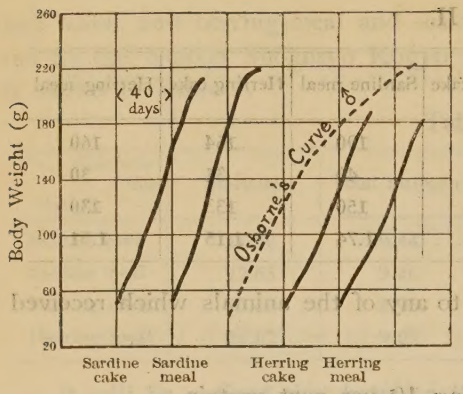

Fig. 3. Growth Curves at a 15% Level of Sample in the Diet.

growth responses were shown in Fig. 3 and Table IV. The growth responses by the male albino rats were the same as that in Exp. 1 and 2.

Summary.

A study was made on the nutritive values of the meals as well as the cakes of sardine and herring. When the protein level is above 8.5 per cent, the growth response was so excellent that the growth rate in any case far exceeded the Osborne's rate. It was clearly shown that the sardine products have a superior feeding quality over the herring products.

Table IV.

Body weight (g) \ Sample	Sardine cake	Sardine meal	Herring cake	Herring meal
At the end of the experiment	212	216	188	182
At the begining of the experiment	50	51	46	47
The increase in the body weight	162	165	142	135
Average daily increase	2.42	2.46	2.12	2.01

In conclusion, the authors wish to express their indebtedness to Mr. S. Ikari for his assistance, and to the Nippon Shokuryo Kogyo Co. for providing the samples.

Reference.

(1) Weber, F. C.: Bulletin No. 378, U. S. Dept. of Agriculture (1916)
Ashbrook, F. G.: Bulletin No. 610, U. S. Dept. of Agriculture (1917)
Daniel, E. P. and McCollum, E. V.: Investigation Report No. 2, U. S. Dept. of Commerce (1931)
(2) Maynard, L. A. and Tunison, A. V.: J. Soc. Chem. Ind., **51**, 53 (1932)
Wilgis, H. S., Norris, L. C. and Herser, G. F.: Ind. Eng. Chem., **27** (1935)
Pottinger, Harrison, and Anderson: Investigation Report, No. 3, U. S. Dept. of Commerce (1935)
(3) Kick, M. C. and McCollum, E. V.: Amer. J. Hyg., **8**, 67 (1928)

ABSTRACTS
from
TRANSACTIONS published in JAPANESE

(Pages refer to the Japanese originals of this volume unless otherwise noticed)

Studien über Sericin.

I. und II. Mitteilung.

(ss. 1195~1207)

Von Takeo Ito und Kozo Komori.

(Aus dem chemischen Laboratorium in Seidenbau-Hochschule, Kyoto;

Eingegangen am 25, September 1937.)

I. Der Kokonfaden (Bombyx mori) besteht aus zwei, von einer gemeinschaftlichen Hülle vom Sericin (Seidenleim) umgegebenen Fibroin-Fäden. Das Sericin macht ungefähr 20~25% der Kokonschicht, welcher der Faden entstammt, aus, und kann aus dieser mittels heisses Wasser extrahiert werden. Aus vorliegenden Versuche bezüglich der Sericin-Extraktion ergab sich, dass beim Behandeln der Kokonschicht mit heissem Wasser Ammoniak entsteht, und zwar in umso grösserer Menge, je höher die Temperatur und je länger die Dauer der Erhitzung ist, wie aus der folgenden Tabelle zu ersehen ist.

Tabelle I.

Ammoniak Abspaltung: mg Ammoniak-N/100 g Kokonschicht.

Temperatur / Erhitzungsdauer	90°	100°	110°	120°
½ St.	——	——	35.2	——
1	70	18.7	53.5	104.7
2		32.7	81.5	
4		55.5	119.2	
8		91.4	174.8	

II. Nach Untersuchungen von einer Anzahl Autoren soll das Sericin aus mindestens zwei Fraktionen bestehen. Eine davon (Sericin-B) kann nach H. H. Mosher aus der Sericinlösung dadurch quantitativ gefällt werden, dass man den pH-Wert der Lösung durch Zusatz von verdünnter Schwefel- bzw. Essigsäure auf 4,1 bringt, wobei die andere Fraktion (bzw. Fraktionen; Sericin-A) in Lösung zurückbleibt und nachher durch Alkohol-Zusatz ausgefällt werden kann.

In Anbetracht der grossen Bedeutung dieser Fraktionierungsfrage für die „Filature"-Chemie haben wir in der vorliegenden Arbeit das angeführte Verfahren Moshers nachgeprüft. Dabei kam die Sericinlösung, welche aus Kokonschicht durch Extraktion mit Wasser bei 110° hergestellt worden war,

als Versuchslösung zur Anwendung. Unter Verwendung von 0,02 m Acetatpuffern hat man bestätigt, dass das Maximum der Flockung des Sericins in allen versuchten Fällen stets bei einem pH zwischen 3,6 und 3,8, anstatt bei dem von Mosher angegebenen pH=4,1, auftritt.

Weiter wurde festgestellt, dass die maximal ausfallende Sericinmenge derjenigen Menge von dem in der Versuchslösung enthaltenen, gesamten Sericin annähernd proportional ist, vorausgesetzt, dass die Konzentration der Lösung verhältnismässig klein ist, d. h. kleiner als ca. 2,5 mg Sericin-N/20 ccm. Diese Tatsache lässt sich leicht durch die Annahme erklären, dass das Sericin, wie schon erwähnt, aus zwei Fraktionen zusammengesetzt sei, von denen eine (Sericin-B) bei isoelektrischem Punkt un- bzw. schwerlöslich ist, während die andere (Sericin-A) leichter löslich ist.

Bei höheren Konzentrationen vermehrte sich das Mengenverhältnis von dem maximal ausfallenden Sericin. Eine Erklärung für diese Erscheinung bleibt noch aus.

Schliesslich haben wir Sericin in der erwähnten Weise fraktioniert, und den erhaltenen Fraktionen analysiert. So wurde der N-Gehalt gefunden: für Sericin-A zu 17,37%, und für Sericin-B zu 16,88%. Diese Zahlenwerten stimmen mit denjenigen, welche von Inoue für β- und α-Sericin zu 17,31% bzw. 16,94% bestimmt worden sind, ziemlich gut überein. Es ist recht wahrscheinlich, dass unser Sericin-A und β-Sercin Inoues dieselbe Sericinfraktion darstellen. Dasselbe gilt für Sericin-B und α-Sericin.

Study on Selenium Catalyst in the Determination of Nitrogen by Kjeldahl's Method.

(pp. 1208~1214)

By K. Nakajima and M. Ikeda.

(Honen Seiyu Kenkyusho, Tokyo, Received Sept. 16, 1937.)

A study of selenium catalyst in the determination of nitrogen by Kjeldahl's method has been carried on by many investigators since M. F. Lauro's study. They have believed it more effective than any other catalyst. Recently, A. E. Beet and his collaborators determined with selenium catalyst the optimum digestion time for various materials. We have traced the studies of previous investigators taking soy bean flour (benzine extracted) and rape seed cake as samples. The selenium catalyst (the composition being the same as that used by A. E. Beet) was compared with that of copper sulphate composed of 9 parts of $K_2SO_4 \cdot 2H_2O$ and 1 part of $CuSO_4 \cdot 5H_2O$.

The result was summarized as follows:

(1) Ten grams of selenium catalyst were optimum in the digestion of 1 gram of sample. For soy bean flour 10 minutes of "after boil" was necessary and sufficient. For benzine extracted rape seed cake, it was 20 minutes.

(2) Ten grams of copper sulphate catalyst were also necessary for 1 gram of sample and 50 minutes of "after boil" were necessary and sufficient.

(3) In case of selenium catalyst the optimum digestion time was about half that of copper sulphate catalyst.

(4) The quantity of nitrogen obtained with copper sulphate catalyst was slightly lower than that with selenium.

Chemical Studies on Silk Fibroin (VII, VIII).

(VII) The absortion of acids, dyestuffs and metallic salts.

(pp. 1215~1230)

By Hideo KANEKO.

(College of Sericulture & Silk Industry, Ueda; Received September 7, 1937.)

It is well known that silk readily absorbs dilute acids from sollutions, and in so doing increases in lustre and acquires the scroop. Fibroin A component absorbs inorganic acids, acid colors, iodine and heavy metallic salts to a greater extent than fibroin B. On the other hand organic acids and basic colors are absorbed greatly by the latter. These results may be due to the difference of chemical active groups such as amino or carboxyl group on the surface of fibroin component micelles, to the degree of diffusion of ions through their particles and to the effect of sorts of anions in solutions.

The curve of absorption for molecularly dispersed compounds is mean partly molecular adsorption through which chemical reaction takes place and partly surface adsorption (acids and metallic salts). For the molecular colloidal and colloidal dispersed compounds such as tannic acid, ferric chloride and some of acid colors the curve of absorption is mainly mean the surface adsorption; that is to say, fibroin has a strong affinity for tannic acid and dyestuffs, which fact is utilized for weighting, mordanting and dyeing the silk fibre. In this case the colloidal properties of the system far outweigh the chemical forces of primary valence within the fibroin components and Freunclich's adsorption formula is well applied.

(VIII) Action of nitric and nitrous acids :

By Hideo KANEKO and Yoshio NAKAZAWA.

Nitric acid absorbs a large amount by fibroin and colors it yellow, due to the formation of nitro-fibroin.

In this case fibroin A acquires a deeper yellow color than fibroin B. Fibroin components can be diazotised with nitrous acid, and coupled with naphtols, phenols and amines, to form new azo dyestuffs on them. The hue of azo dyestuffs developed on the fibroin components and fibre is different in some cases according to the difference of surface properties of them.

On the Reaction and Exchange Capacity of the Soil of Hiraodai, a Plateau of Paleozaic Limestone, in North-Kyushu.

(pp. 1231～1234)

R. KAWASHIMA.

(Agr. chem. laboratory, Kyushu Imperial University ; Received September 11, 1937.)

The elevation of Hiraodai is 300～400 meter over sea level. The climatic records are not available. But it may be safely supposed that the mean annual temperature is somewhat lower than 15.2°C and the mean annual rainfall is somewhat higher than 1623.6 mm.

Some chemical data of soil samples collected on this plateau are given in the table.

Some chemical data of air-dried fine soil.

Soil number	Vegetation	Layer	Exchange acidity ($y_1 \times 3$)	Hydrolytic acidity (y_1)	pH		Exchange capacity M.E. per 100 g soil	Exchange. Ca M.E. per 100 g. soil
					H_2O	KCl		
1	Pine forest	Surface	21.6	32.6	4.84	3.87	15.21	2.62
2	Pine forest	Subsoil	32.8	21.6	5.03	3.75	11.98	2.02
3	Tea plant	Surface	1.1	24.1	5.33	4.27	17.30	4.59
4	Native grasses	Doline, Surface	2.3	35.9	5.29	4.25	21.10	3.93
5	,,	Subsoil	0.8	15.4	5.48	4.62	12.50	1.26
6	,,	,,	43.1	25.4	5.22	3.75	14.80	1.91
7	,,	Surface	0.4	17.6	6.29	5.31	34.69	20.64

As in the above table, it is noteworthy to see that all soils are more or less acidic and their exchange complexes, except one soil, are extremely deprived of lime and enriched with hydrogen.

Neither rendzina nor terra rossa are found there.

On the thermophilic Microorganisms isolated from kibbled Soy Bean Cake which was spontaneously heated.

(pp. 1235～1256)

By Bunzo ROKUSHO and Hiroshi FUKUDOME.

(Received September 13, 1937.)

Three thermophilic microorganisms viz. one mold and two bacteria are isolated from kibbled soy bean cake which was spontaneously heated. The mold is "Dactylomyces thermophilus Sopp" and the bacteria are new species which are named "Bacillus thermophilus sojae No. 1" and "Bacillus thermophilus sojae No. 2."

Dactylomyces thermophilus grows well at 40～45° and the max. temp. for growth is 55°. This mold grows well in soy bean extract medium and decomposes protein to produce ammonia and amino acids. Oil is decomposed to fatty acids. The mold produces heat in moistened, sterilized, kibbled soy bean cakes containing 26～38 percent of water in Dewar flask to 60～62° in 7～8 days after inoculation.

Asperagillus oryzae, Penicillium mandshuricum (Saito) also produce heat upto ca. 55°, but Thermoascus aurantiacus Miehe does not produce heat in the similar experiments that of Dactylomyces.

It seems that the separated mold "Dactylomyces thermophilus Sopp" is responsible for production of heat in the moistened kibbled soy bean cake and damage it.

The two bacteria isolated resemble each other, but in some points they differ. These are both facultative thermophilic bacteria and resemble of the "Type 9" of Bergey's thermophilic bacteria described in Journal of Bacteriology vol. 4, p. 304, 1919.

The brief description of the two organisms is as follows.

Rods: No. 1 $0.6 \times 1.8 \sim 2.4 \mu$, No. 2 $0.6 \times 2.4 \sim 3.6 \mu$. Both are motile, but organ of motility is not successfully determined.

Spores: No. 1 $0.6 \sim 0.72 \times 1.2 \sim 1.5 \mu$, centre or terminal. Rods swollen a little at sporulation. No. 2 $0.6 \times 1.2 \sim 1.5 \mu$, center or terminal.

Both bacteria are Gram possitive, no reserve material demonstrated. Liquefy gelatin and produce yellow pigment from it.

Flesh agar colony: No. 1 small, grayish, granular, lobate. No. 2 whitish, glistening, flat, auriculate.

Flesh agar slant: No. 1 grayish white, winkled, spreading, non-adherent. No. 2 grayish white, wrinkled, glistening, spreading, non-adherent.

Broth: Both organisms clear, with white, strong, wrinkled pellicle and no sediment.

Litmus milk: Both organisms acid coagulation and peptonisation.

Potato: Both organisms no growth.

The following characteristics are in common in both organisms.

Indol: Not formed.

Nitrate: Reduced to nitrite.

Hydrogen sulfide: Formed.

Accethyl methyl carbinol: Not formed.

Methylen blue: Reduced.

Invertase: Positive.

Lipase: Positive.

Protease: Positive.

Tyrosinase: Negative.

Starch: Decomposed but does not produce reducing sugar.

Requirement of oxygen: Aerobic.

Thermal death point at 100° in minutes: 15.

Production of pigment: The pellicle is stained in redish brown color in the glucose broth, yeast water, starch yeast water and Koji extract medium. Stained in yellow color in gelatin broth, but not in plain broth.

Formation of acid from carbohydrate and alcohol.

In synthetic medium acid is formed from the following materials by both organisms.

Arabinose, xylose, rhamnose, dextrose, galactose, laevulose, mannose, melibiose, saccharose, trehalose, dextrine, inulin, pectin, starch, amygdalin, salicin, α-methyl-glucoside, glycerol, mannitol.

No acid is formed from melizitose and monohydric alcohols. Small quantities of acid is formed from lactose, raffinose and glycogen by both organisms.

From lactose and raffinose No. 2 produces more quantities of acid than No. 1.

Optimum temperature for growth: No. 1 40～55°, No. 2 40～50°. Both organisms will grow between 25° and 60°.

Resistance to sodium chloride: No. 1 can grow equally well in 0～8 per cent NaCl medium, No. 2 0～10 per cent. No. 1 can not grow in 15 per cent NaCl medium while No. 2 can grow a little in the some concentration.

Production of heat: Both bacteria can not produce heat in moistened, kibbled soy bean cake.

On the Fixation of Sericin of Raw Silk (Part I).

Fixation of Sericin by Chromium Salts.

(pp. 1257~1267)

By Masami Oku and Zirô Hirose.

(From the Chemical Laboratory of Gunze Raw Silk Mfg. Co. Ltd., Ayabe-mati, Kyoto-hu; Received September 13, 1937.)

We mean the fixation of sericin of raw silk by making sericin insoluble in boiling water and fixing it firmly to the fibroin by chemical treatment. The purpose of the present study is to find out some new fields of utilization of raw silk and to make clear some unknown physico-chemical properties of sericin by the above process.

In this paper we reported the reason why the fixation of sericin by chromium salts occurs and some experimental results by this treatment which was summarized as follows.

(1) The theory of fixation of sericin could be reasonably interpreted from the standpoint of chrome tanning theories of collagen. Thus, in our experiments, the tanning processes by one-bath and two-bath methods which are used in the case of chrome tanning were employed and obtained some remarkable results.

(2) Adsorption of chromium by sericin on raw silk was estimated and found it to follow the formula of Freundlich's adsorption isotherm.

(3) As the sericin on yellow raw silk fibre takes up minor amount of chromium than that on white raw silk, there exists some physicochemical combination between xanthophyll and sericin of the yellow fibre, as was already discussed in our previous papers.

(4) Relation between the insolubility of sericin and the amount of chromium adsorbed was studied. Even 1% of Cr_2O_3 taken up by goods was greatly facilitated for the purpose of fixation, but more than 6% Cr_2O_3 of the goods gave, on the contrary, increase of boiling off of the treated fibre. In later case, there presumed to exist chromium salts of the deposited form on the raw silk fibre.

(5) Strength and elongation of the original raw silk was not at all affected by fixation of its sericin by chromium salts.

(6) As the results of fixation of sericin, there formed many scaly cleavages on the surface of the raw silk fibre, thus the nature of the original fibre was altered, giving wool-like features.

Enzymatic Studies of Cereals (Part VII).

On the Dextrifying Amylase of Rice-Seeds.

(pp. 1268~1274)

By Gohei YAMAGISHI.

(Morioka Imperial College of Agriculture and Forestry; Received September 9, 1937.)

In the previous papers of this series the author has reported the liquefying and saccharifying amylase of rice. It is the purpose of this investigation to study the dextrifying amylase in the rice grain.

The dextrifying power was measured by the iodine-starch colour test according to the method of Wohlgemuth.

The results obtained from this investigation may be summarized as follows:

(1) Studies were made on the dextrifying amylase in the unhulled rice, uncleaned rice, cleaned rice, and rice bran.

(2) The optimum hydrogen ion concentration for the dextrifying amylase in the equeous extracts of the unhulled rice, uncleaned rice, and rice bran was found to be about pH 6.3 in all cases.

Both the amylase extracted from the uncleaned rice flour with 0.1 m potassium sulphate solution and the precipitated amylase from the aqueous extract with alcohol showed the same optimum pH as above.

(3) Under the writer's experimental conditions (24 hours and 6.3 pH), the dextrifying amylase exhibited the maximum activity at 25°C.

(4) About the relation between the distribution of the dextrifying amylase in the rice grain and the enzymic form, it was confirmed a following results:

Most of the water-soluble dextrifying amylase which is readily extracted with water is existent in the exterior of the rice grain and its content is markedly reduced as approaching the centre of grain; in the inner part of the grain, however, the water-insoluble enzyme which may be rendered soluble by adding the salt solution, is more present as compared with the soluble one.

Enzymatic Studies on Cereals (Part VIII).

On the Amylases in Germinated Rice.

(pp. 1275~1283)

By Gohei YAMAGISHI.

(Morioka Imperial College of Agriculture and Forestry; Received September 9, 1937.)

In the previous papers the author bas been studied about the amylases in the unsprouted rice-seeds. This time I have undertaken a study of the liquefying, dextrifying, and saccharifying amylase in the sprouted rice.

My results are as follows:

(1) The optimum pH of the liquefying, dextrifying, and saccharifying amylase in the germionated rice, lies in about 4.5, 5.2, and 5.3 respectively. These pH values are more or less different from those of the ungerminated one.

(2) When the digestion time is one hour, each amylase in the germinated rice shows a different optimum temperature; namely the liquefying, dextrifying, and saccharifying amylase 50°C, 45°C, and 55°C respectively.

(3) It was confirmed that there was an optimum temperature for the extraction of the amylases in the ungerminated and germinated rice; i. e. in the case of the sprouted one, 40°～45°C was most suitable for the extraction of all the amylases, whereas in the case of the unsprouted rice-seeds, 40°C for the liquefying amylase, below 10°C for the saccharifying amylase, and 5°～40°C for the dextrifying amylase.

(4) The destruction temperature at which the enzymic activity may be reduced by half for one hour, was found to be about 66.5°C for the saccahrifying amylase, 71.5°C for the dextrifying amylase, and 75°C for the liquefying amylase.

Enzymatic Studies on Cereals (Part IX).

On the Developement of Amylases during the Germination of Rice.

(pp. 1284～1295)

By Gohei YAMAGISHI.

(Morioka Imperial College of Agriculture and Forestry; Received September 9, 1937.)

In the paper VIII of this series the author has determined the optimum temperature for the extraction and the enzyme action, the optimum pH, and the destruction temperature for all the amylases in the germinated rice.

In the present paper I wish to report on the rice and fall of the amylase activity through the course of the germination of rice-seed and the distribution of the amylases in the germinated rice.

These findings indicate that:

(1) It has been conceivable to be increasing the amylase activity still more after 21 or 17 days, performed a germination at 20°C or 25°C. In the case of germination at 30°C, however, it was observed that the maximum activity was gained after one week.

(2) Of the three amylases, the liquefying amylase has been most increased at the germination and has taken the most time for attaining the maximum enzyme activity.

The dextrifying amylase comes next to the liquefying one.

The saccharifying amylase has attained to a maximum more quickly than any other amylases and the rate of decrease after that time was most remarkable.

(3) According to the results of these experimente, at least, the germinated sample at 25°C has showed a maximum activity for the liquefying and dextrifying action, whereas the germinated one at 30°C for the saccarifying action.

(4) It was observed that the state of germination and the enzyme content was influenced by the quantity of supplied water during the germination;

When the water supply is abundant the plumule grows vigorously and the elongation of radicle is highly restricted.

In the case of the germinated sample under water the amylase content is very low; especially the dextrifying activity is most influenced (1/5.5), the liquefying activity is next to it (1/3.4), and comes to the last the saccharifying activity (1/2.9).

(5) When the hulled-rice-seed is germinated, the time-rate of increase of the enzymic power on germination is greater than the case of the unhulled-rice-seed.

(6) In the ungerminated rice-seeds there is in existence the water-insoluble zymogen amylase in addition to the soluble amylase, but in the germinated one nearly all the enzyme is readily soluble in water (so-called free-amylase).

(7) In respect to the distribution of the amylases in the germinated rice it was conceived the following fact;

The amylase-content of the germ and radicle of the germinated rice was found to be extremely lower than that of the grain body of the germinated one, especially the saccharifying amylase was most remarkable.

(8) The results described in the present report are in accordance with my previous opinion that the liquefying, dextrifying, and saccharifying amylase is existent for oneself in the ungerminated and germinated rice.

Experiment on the Colon Group of Fishes. (IV, V) (continued)

(pp. 1296~1324)

By Yutaka YASUKAWA.

(The Department of Food Control of the Government Institute from Infectious Disease, Head of the Department: Dr. Y. Tohyama; Received June 10, 1937.)

On the study of Soils containing alkali salts in Hulumpeierh, Northwestern Manchoukuo.

(pp. 1325～1337)

By Minoru IKEDA.

(Kunchuling Agr. Exp. Sta. S. M. R. Co.; Received Oct. 4, 1937.)

The soils containing alkali salts in Hulumpeierh belong to alkali soil (Solonetz) at northern part, intermediate type of alkali soil and saline soil (Solonchak) at middle part and saline soil at southern part, considering from morphological feature, chemical constituents, climatical condition and ground water level etc.

On the Contents of 0.2*N*HCl soluble Phosphoric Acid of Tyôsen Soils (III).

(pp. 1338～1350)

By Dr. MISU-Hideo.

(Chemical Department, Agricultural Experiment Station of Government General of Tyosen; Received Oct. 1, 1937.)

Researches on the Manufacture of Alcohol from the Manchurian starchy Materials (Part I～III).

(Amylo- and acid-hydrolysis- Process)

(pp. 1351～1400)

By E. YOSHINO, W. YOKOYAMA, T. MAKIHARA, M. NAGASHIMA and M. OKAHAYASHI.

(Central Laboratory, South Manchuria Lailway Co., Ltd.; Received October 5, 1937.)

(1) As the cooking conditions of the materials are the fundamentals of these researches, we determined the optimum conditions concerning the concentrations and quantities of acid (HCl), temperature and time of cooking.

The opt. conditions are as follows:

acid solution (HCl, 0.06%) used, 6～8 times the weight of material, temperature 155°C and duration 1 hr.

(2) Kaoliang (Sorghum Brot.) grain contains both tannin and coloring matter in the outer skin, which give an unfavorable effect on the digestion for domestic animals and retard the actions of amylase, zymase and other enzymes.

By removing them by means of polishing grains or by the use of precipitants we were able to obtain good results of fermentation.

(3) The Kaoliang bran which is produced as a byproduct when the grain is polished is rich in tannin and coloring matter. We treated Kaoliang bran with such tannin precipitant as $FeCl_3$ during the cooking, or with ozone or NO_2 before steaming and found it to be well utilized as a raw material of alcohol manufacture.

(4) We recognized that the hardness of Koaliang grains remarkably varied by the difference in the place of production such as in Manchuria, Korea, or in Japan. The grains produced here in Manchuria are the hardest while those of Korea and Japan are soft.

Similar phenomena was observed in corns which were harvested in Manchuria, Algentina and Africa.

(5) Kaoliang, expanded by heat, was again cooked, but contrary to our expectation, no increase of alcohol yield, was observed. The cooking temperature was, however, able to be lowered by about 20～30°C.

(6) We made same experiments applying amylo-process on other materials such as corn, millet, rice and potato.

In all of them except potato the yield of alcohol was generally good being about 90%.

(7) Among 92 species of yeasts which were collected from various laboratories or isolated from the cultures or mashes of various factories were observed that the yeast, the so-called No. 50 had the greatest activity of alcohol production, and, therefore, we used it through the most part of our experiments.

We worked, however, unsuccessfully to choose the moulds with greater amylolytic power than Rhiz. Delemar.

(8) Under similar conditions with those in the laboratory, we carried out many practical experiments of amylo-process under a semi-industrial scale, getting good results as we expected.

(9) With the experiments using acid-hydrolysis process applied on Kaoliang (Sorghum Brot), we obtained the results just as good as those of amylo-process.